

The Trash Torch



Objective

To teach students about combustion and waste-to-energy facilities as a means of trash disposal, including how these facilities work and the related issues and concerns.



Activity Description

Students will calculate the weight and volume of trash before it is burned, observe the combustion process, and weigh and measure the ash that remains.



Materials Needed

- One empty metal coffee can (16 ounces)
- One punch-type can opener
- One piece of wire mesh large enough to fit over the top of the can
- Five pieces of cardboard, 4 by 4 inches
- One roll of masking tape
- One scale
- Several pieces of garbage such as eggshells, orange rinds, napkins, and notebook paper (enough to fill the 4- by 4-inch box). Remember NOT to include anything like plastic, rubber, or products containing potentially hazardous chemicals
- One pack of matches
- One fire extinguisher
- One copy of the *Combustion Calculator* worksheet per student



Key Vocabulary Words

Combustion
Incinerate
Waste-to-energy
Ash
Air emissions



Duration

1 hour



Skills Used

Computation
Observation/classification



social
studies



science



math



Activity

Step 1: For safety reasons, setup is extremely important for this activity. Make sure you:

- Choose an appropriate location outside the school for this activity. The location

should be at least 100 feet from trees, buildings, and shrubs.

- Check with school/community administrators about any burning regulations or restrictions.
- Instruct students on proper safety behavior for the activity, including keeping a safe distance away from the fire at all times.



Journal Activity

Have students write a pretend newspaper story about a new combustion facility in their neighborhood. Where is it? How do people feel about it? What are the benefits and drawbacks?

Photocopy and distribute the *Combustion Calculator* worksheet to each student. (Refer to the Teacher Fact Sheet titled *Combustion* on page 159 for background information.) Introduce the following concepts to students:

- Combustion as a waste disposal method.
- Waste-to-energy facilities.
- Advantages and disadvantages to combustion and waste-to-energy facilities.

Step 2: Have student volunteers tape the pieces of cardboard together to form a small box or have them use small boxes you already have (to promote reuse). Have students weigh the box on the scale and record this number on their *Combustion Calculator* worksheets. Next, place the garbage in the box. Have students weigh the box with the garbage and record this number on their worksheets. Then, ask students to calculate the weight of the garbage based on these two figures.

Step 3: Next, have two or three student volunteers use a ruler to measure the length, width, and height of the box. Ask students to record these numbers, calculate the volume of the garbage in the box, and record this number on their *Combustion Calculator* worksheets. Ask students to predict how these numbers will change after the garbage has been combusted. Have them record their predictions on their worksheets.

Step 4: Take the class outside to your pre-selected experiment location. Use the masking tape to make a line on the ground designating

a "safety zone" (8 to 10 feet from the coffee can) behind which students can safely watch the experiment. Remind students that this experiment should be conducted by adults only and should NOT be attempted at home.

Step 5: Use the punch-type can opener to punch several holes around the bottom of the coffee can. Explain that this will allow oxygen to enter the can and assist the burning process. Pour the trash from the cardboard box into the can, and light the contents on fire. Immediately place the wire mesh over the top and step back behind the "safety zone" line with students. The mesh will keep the burning trash safely contained in the coffee can. Have students observe what they see, smell, or feel and record these thoughts on their worksheets.

Step 6: After the trash has finished burning and the can and contents have completely cooled, place the remaining ashes back into the cardboard box and have new student volunteers weigh them and record the results. Ask the students to observe the difference in volume of between the garbage and its ash.



Assessment

1. Ask students to think about what happened during the combustion process and explain how this method of trash disposal saves landfill space. What changed in terms of weight and volume?
2. Have students complete the math word problems on their worksheets.
3. Ask students to explain how this method of trash disposal might generate energy. Did they observe any evidence of energy being created during the experiment?
4. Ask students to list any problems they observed that might be associated with combustion. What was in the smoke that was emitted to the air? Ask students what might have happened if rubber or plastic had been burned?



Enrichment

1. If possible, visit a waste-to-energy facility on a field trip. Have students write essays about the visit when they return. Or, invite a guest speaker to talk about waste-to-energy facilities (a county manager, a county engineer, or a local solid waste officer).
2. Investigate the role that oxygen plays in combustion by repeating the experiment using another coffee can that does not have holes punched in the bottom. You might also reuse the first can with various amounts of trash to investigate the most efficient combination of air and fuel for complete combustion.
3. Contact your solid waste department for information about how much trash is burned at combustion facilities across the country per year. Also find out how much ash is produced from this combustion. Have the students create charts that show the difference in the amount of waste (trash versus ash) headed to landfills.

Name: _____

Combustion Calculator

Trash

Weight of box = _____

Weight of trash + box = _____

Weight of trash = _____

Volume of trash in box = _____
(Volume = length x width x height)



My predictions for after the trash is burned:

Weight of trash = _____

Volume of trash in box = _____

Combustion

My observations during the experiment:

Ash

Weight of ash + box = _____

Weight of ash = _____

Volume of ash in box (estimate)
= _____

Reduction of trash through combustion:

Volume of trash _____ - Volume
of ash _____ = _____

Combustion Word Problems

Every year, each of us generates about 1 ton of garbage. One person's yearly garbage fills 27 large garbage cans.

1. When 1 ton of garbage is combusted in a waste-to-energy facility, we recover 500 kilowatt hours of energy. Assuming electricity costs 7 cents per kilowatt hour, how much is the energy contained in 1 ton of garbage worth? _____

2. As we learned in question #1, 1 ton of garbage contains 500 kilowatt hours of energy. This amount of energy can light a lamp for 5,000 hours. How many hours could you light a lamp if you had the energy contained in 42 tons of garbage? _____ How many days? _____ How much money is this amount of energy worth? _____